SMART TRANSPORT SYSTEM
SIGNALLING SENSOR SYSTEM NEAR HAIRPIN BENDs

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Abstract: often modern cars have a collision avoidance system built into them known as Pre-Crash system, or Collision Mitigation system, Forward collision warning system in order to reduce the severity of a collision. But majority of vehicles on the road, especially heavy motor vehicles lack in such a system. In this paper, the implementation of the Collision Avoidance System is aimed to reduce the risks of collisions at the hairpin bend on a Hilly track, Ghats or other zero visibility turns. The proposed system contains a set of ultrasonic sensors, warning lights combined with a convex mirror is installed by the side of the road. It uses four ultra sonic sensors, which are placed on either side of the hairpin bend. The sensors are mutually exclusive and are connected by wires. The priority algorithm intelligently controls the movement of the vehicles at the hairpin bend based on the sensors values giving appropriate warnings on detection. For different conditions appropriate warning LED is triggered thereby prioritizing the vehicles movement. In case of a system breakdown a caution LED is triggered also sending a signal to notify the maintenance department about the same.

Key words: Collision Avoidance, Hairpin bends, ultrasonic sensors, Warning LEDs.

1. Introduction

A rapid growth in transportation and vehicles have resulted in an increase of accidents every day. Accidents mainly occur due to carelessness, breaking traffic rules and bad conditions of the road. As a major component of the road geometric design, curved road segment, due to their alignment characteristics are most prone to traffic crashes among all road geometric elements. According to a survey, crashes on curved segments accounted for 10% of total number of traffic crashes. Correspondingly, the number of deaths accounted for 13% of total number ofdeaths.

In Narrow roads, Hilly areas, Ghats sections, negotiating hairpin bends and curves is not an easy task. Driver has to be alert all the time while driving in such situations. Accidents mainly occur due to over speeding of vehicle while driving through a sudden curve. In Ghats and hairpin bends, first preference should be given to vehicles movinguphill. But, rules are not strictly followed and hence resulting in road blocks and accidents. In existing system drivers are unable to judge which and when vehicles arrive at curves. Hence we have developed a model using which drivers can pass the curve and judge the arrival of the vehicles from the other end moreconfidently.

1.1 Objectives ofstudy

The following are the main objectives of the study

1. To reduce the accidents in hairpin bends.
2. To control the trafficdensity.
3. To prevent noise pollution caused due to horns.
4. To facilitate smooth andefficient movement of thevehicles.
5. To reduce the confusion of drivers at conflictpoints.

2. Methodology

1. Detailed survey of the road.
2. Determination of trafficdensity.
3. Design ofsensors.
4. Location and installation ofsensors.
5. Protection of sensors from climaticconditions.
6. Checking the efficiency and working ofsensors.
7. Detailed estimation ofproject.

This project proposes a simplistic approach for the implementation of a Collision Avoidance System in hairpin bends on a hilly track, Ghats, or zero visibility turns using sensors and signals. It uses four Ultrasonic sensors, which are placed on either side of the hairpin bend. Two sensors S1and S2 is installed by the side of the uphill section of the road, similarly one more sensor S3 and S4 is installed by the side of the downhill section of the road. The sensors are mutually exclusive and are connected to microcontroller through wires. Based on the output of sensors, position of vehicles on either side of the bend is detected which is provided as an input to the microcontroller. The microcontroller triggers the warning LED signals to glow on the other side of the curve (L1 in Downhill and L2 in Uphill) and thereby

intelligently controlling the movement of vehicles at the bend. A convex mirror is placed at the center of the outer curve of bend.

A. LED SIGNALS

A pair of LED signals namely L1 and L2 is placed on downhill and uphill direction. This are provided in order to indicate the warning signals according to the vehicles sensed by the Ultrasonic sensor .

B. ULTRASONIC SENSORS

It is a device that can be measure the distance to an object by using sound waves. Ultrasonic sensor emit short, high frequency sound pulses at regular intervals. If they strike an object, then they are reflected back as echo signal to thesensor.

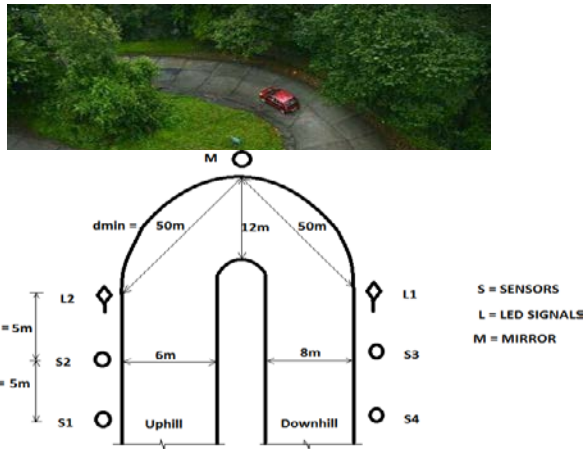
Fig.1:Ultrasonic sensors

C. TRAFFIC MIRROR

Traffic mirrors are safety enhancing specialty convex mirrors which make navigating dangerous intersections, drives and high risk accident areas safer and less stressful.

Fig. 2: Hairpin bends

II. 3. Working



When vehicle enters the road A the sensor S1and S2 will sense it and in road B the LED signal light L1 blinks. If any vehicle is approaching the hairpin bend in road B should stop until vehicle from road A passes sensor placed in road B. Same process will repeat for vehicle waiting in road B. This will reduce accidents in sharp curves.

Fig. 3: Location of sensors and LED's

All four sensors S1, S2, S3, and S4 are initialized to start monitoring the vehicle movement. Sensors S1 and S2 separated by a distance of d = 5m are installed at a distance of dmin = 50m from the center of the hairpin bend. Similarly, S3 and S4 separated by a distance of d = 5 m is placed at a distance of dmin = 50m on the uphill section as shown in Fig. Priority is given to vehicles climbing the curve in order to maintain their momentum. Warning LED L2 is triggered thereby giving priority to the vehicles moving downhill. Similarly LED L1 is triggered thereby giving priority to the vehicles moving uphill.

3.1.Features of Ultrasonic sensors

1. Compact and light weight.
2. High sensitivity and high sound pressure.
3. High reliability.
4. Complex shaped object detectable.

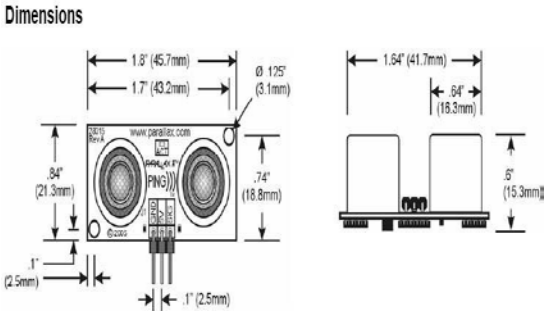
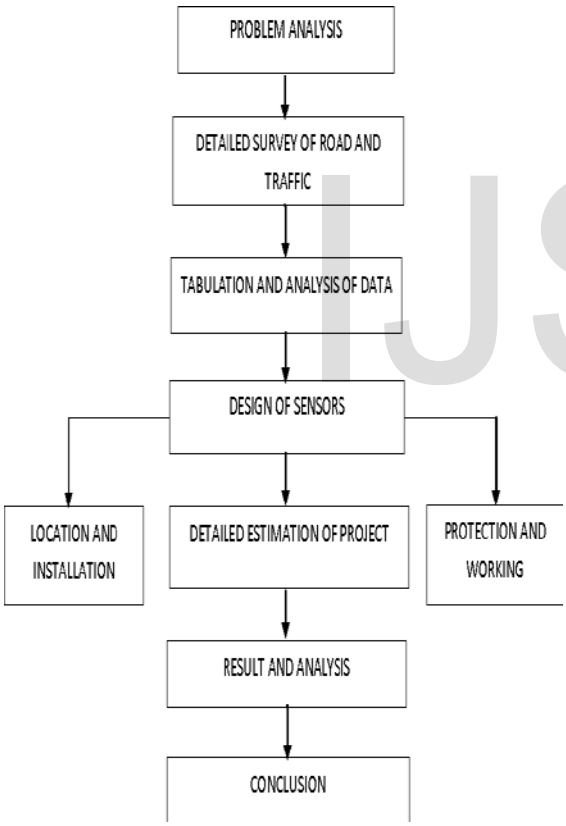


Fig.4: Specifications of Ultrasonic sensors

4.Flowchart



5.Expected outcome

Our Collision Avoidance System consisting of a microcontroller, IR sensors, warning LEDs and a convex mirror when implemented would be proven as more effective than just a normal traffic mirror setup This simple yet effective methodology will enable the driver to have a better sense of terrain and will drastically reduce road accidents in hairpin bends or other kinds of zero visibility turns.

Concluding on a high note the project will give the clear idea for the driver to move in the sharp curves. It will results in safe and efficient movement of vehicles.

6.Advantages

- Accidents will be efficiently reduced in sharp hairpin curves.
- Efficient movement of vehicle will be obtained.
- Reduces confusion and inappropriate movement of the vehicles.
- Traffic density will be under control.
- Gives maximum flexibility and clarity for the road users.
- Provision for the scope of "MAKE ININDIA".
- Reduces the noise pollution created by horn inturn turning out as ecofriendly.

7.Conclusions

- Our collision avoidance system consisting of a Ultrasonic sensors, warning LEDs and a convex mirror when implemented has proven to be effective than just a normal traffic mirror setup.
- This simple and effective methodology will enable the driver to have a better sense of terrain and drastically reduce road accidents in hairpin bends or other kinds of zero visibility turns.
- This idea will make the future transport system smarter and use of upcoming technologies.

8.References

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